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APPALACHIAN FOREST EXPERIMENT STATION

Technical Note No. 13
Pathology.

Asheville, N.C.
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RELATION BETWEEN TREE DIAMETER AND PERCENTAGE OF CULL IN SOME EASTERN HARDWOODS

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U. S. Department of Agriculture.

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Relation Between Tree Diameter and Percentage of Cull in Some Eastern Hardwoods

The accompanying graphs show part of the results of an extensive study of decay in eastern hardwoods. One phase of this work has already been reported on in Technical Note No. 3 of this Station, entitled "Relation between height of decay and tree age in certain eastern oaks". The data upon which Hepting based these graphs were taken on commercial logging operations from 1924 to 1928 by Hedgcock and his associates. The following table shows the states in which the work was done and the number of trees analyzed in each state:

Number of Trees Analyzed by Species and States

State	White Oak	Chest. Oak	N.Red Oak	Scar. Oak	Bl. Oak	Post Oak	Yellow Poplar	Bass-wood
New Jersey	7	19	3	41	5	0	0	0
Pennsylvania	59	200	83	41	0	0	0	0
Ohio	408	137	149	190	549	23	13	0
Maryland	252	1	67	0	37	1	0	0
Virginia (Western)	6	2	5	1	2	0	0	0
West Virginia (East.)	151	106	200	605	160	0	19	2
North Carolina(West.)	108	262	302	53	4	0	156	113
North Carolina(Cent.)	463	0	0	32	61	318	97	0
Tennessee	0	0	0	298	71	0	0	0
Totals	1454	727	809	1261	889	342	285	115

Data were taken on all trees cut on the plots chosen within the logging units. Data were not taken on uncut trees. The gross merchantable tree volumes presented in Figures 1 and 2 are based upon the measurements of logs per tree actually cut by the operators. The logs were scaled by the Scribner Decimal C log rule. A jump butt, or other cull section, if six feet or more in length, was scaled as a separate log; if less than six foot, its length was added to the adjacent log above and its volume included as a part of that log.

The cull presented in Figure 3 represents that part of the otherwise merchantable volume lost by the operator through decay or mechanical defect. This cull volume was computed by measurement of jump butts and other cull sections and

by scaling out the decay in the logs that were to go to the mill. On cross tie and pole operations practically all defects were butted off. On saw-timber operations the length of decay in logs to go to the mill was estimated on the basis of the diameter of the decay at the ends of the logs, and the fungi causing the decay. Certain fungi cause more extensive decay than others.

In order to put the estimates of length of rot based on rot diameter on a sound basis several hundred logs of various species were followed through mills and the length and end diameter of rot were noted. Through this means curves were developed for each species showing the increase in length of rot with increase in rot diameter at the end of the log. Rot in logs that went to the mill was scaled as a right cylinder with a diameter one-inch in excess of the rot diameter at the end of the log according to the rules set forth in "Instructions for the measurement of National Forest timber".

Figures 1 and 2 show the relation between gross merchantable volume and tree diameter breast high by species for all sites and types combined. These graphs were put into two figures only for convenience in reading the curves. Figure 3 shows the relation between cull volume and tree diameter breast high, and is based upon all trees cut, both decayed and sound. Figure 4 is a combination of Figures 1 and 2 with Figure 3, and represents the cull percents by tree diameter classes.

The dip in some of the cull percent curves in Figure 4 in the lower diameter classes is due to the relatively small increase in cull volume for some species compared to the rate of increase of tree volume with diameter in the lower diameter classes. In the higher diameter classes the cull volume increases at a greater rate than does the total gross volume.

The curves for white, chestnut, northern red, and scarlet oaks are the most accurate from a regional standpoint as they have the largest basis, the trees are well distributed over a number of areas, and each is well represented through a good range of diameter classes. The black oak curves are weakened by the fact that 62% of the trees came from one area. Hence the cull figures for black oak are based largely on one fire history. This may account for the relatively low cull percent found for black oak.

In applying these curves the fact must be kept in mind that they are based only on those trees considered merchantable by the different operators. They can not be applied to an entire stand, but can be applied only to the merchantable trees in that stand. While the criterion of merchantability probably varied with different operations, on the average the standards probably approximate fairly closely those of the U. S. Forest Service.

The cull figures presented in this paper may be said, in general, to apply to the Appalachians as a whole. They cannot be expected to apply accurately to any small stand. This is because the cull percent of a specific stand is determined largely by its fire history. 77% of all the defect in the 5,882 trees studied was due to butt rot, 20% was due to top rot, and 3% was due to mechanical defects such as crook and fork. All but a very small part of the butt

rot gained entrance through fire scars. The relation of rot to fire will be treated in a separate paper. With the amount of cull so related to the amount of fire scarring, it is obvious that otherwise comparable stands, even within a given small watershed, might have widely different proportions of cull if their fire histories were different.

The cull percentages presented in Figure 4 could probably be applied with reasonable confidence on relatively large units, which might be said to have average fire histories, such as national forest working circles. On land protected from fire the future cull should be less than is shown here.

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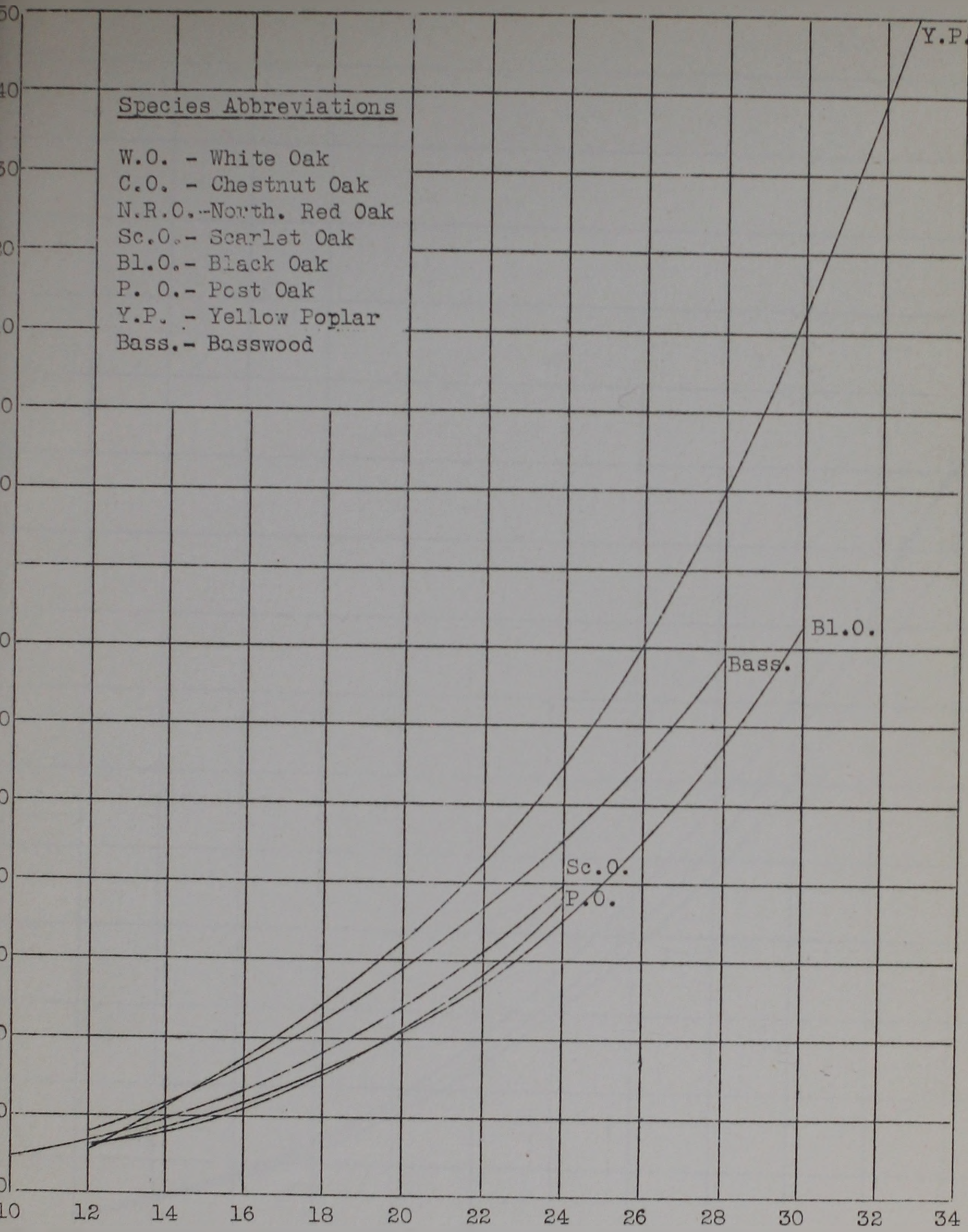
FIGURE 1

Relation Between Gross Merchantable Volume* and D.B.H.

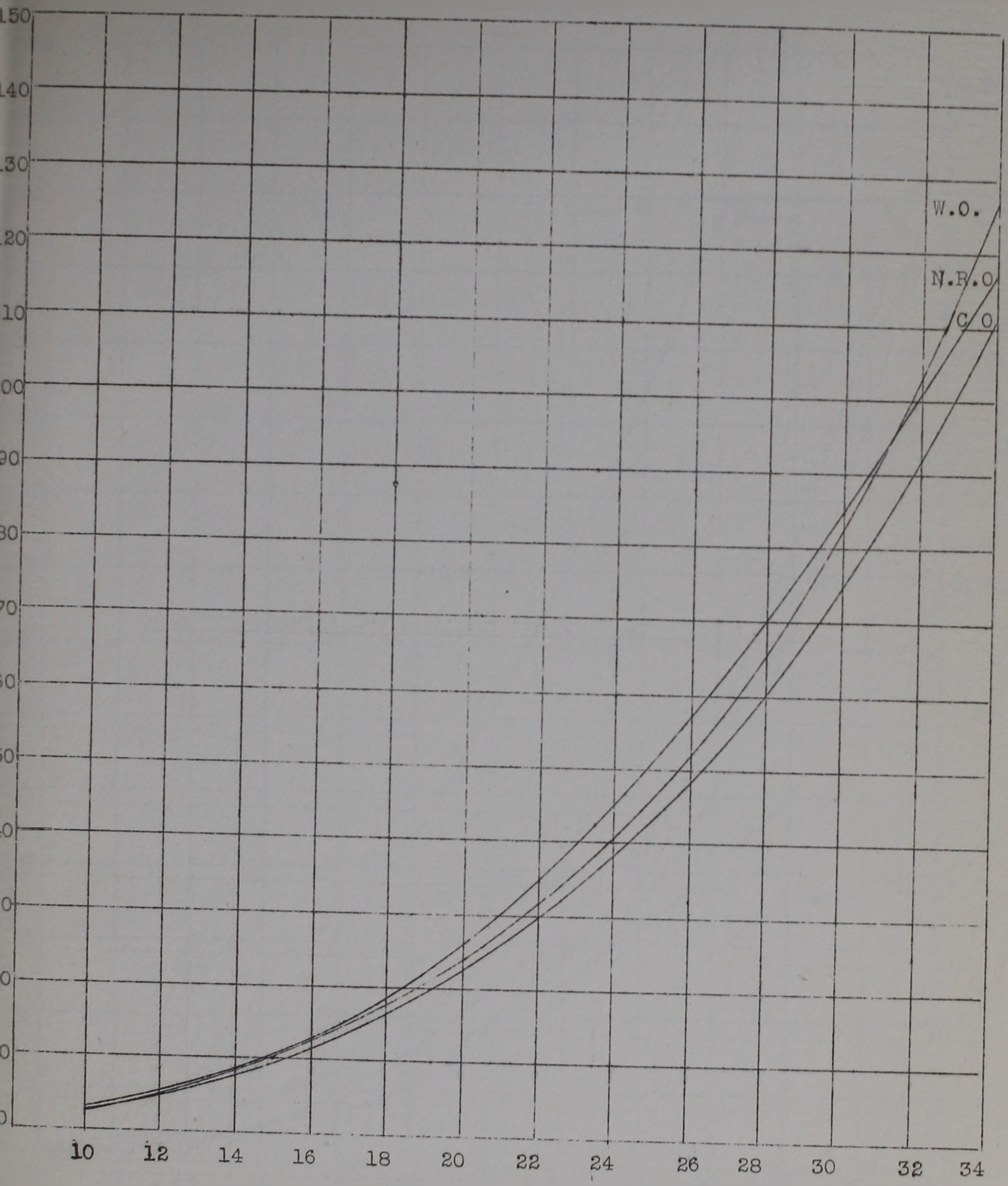


Diameter Breast High in Inches

*---Based on total volume from stump to top diameter to which operators cut.

FIGURE 2

Relation Between Gross Merchantable Volume* and D.B.H.

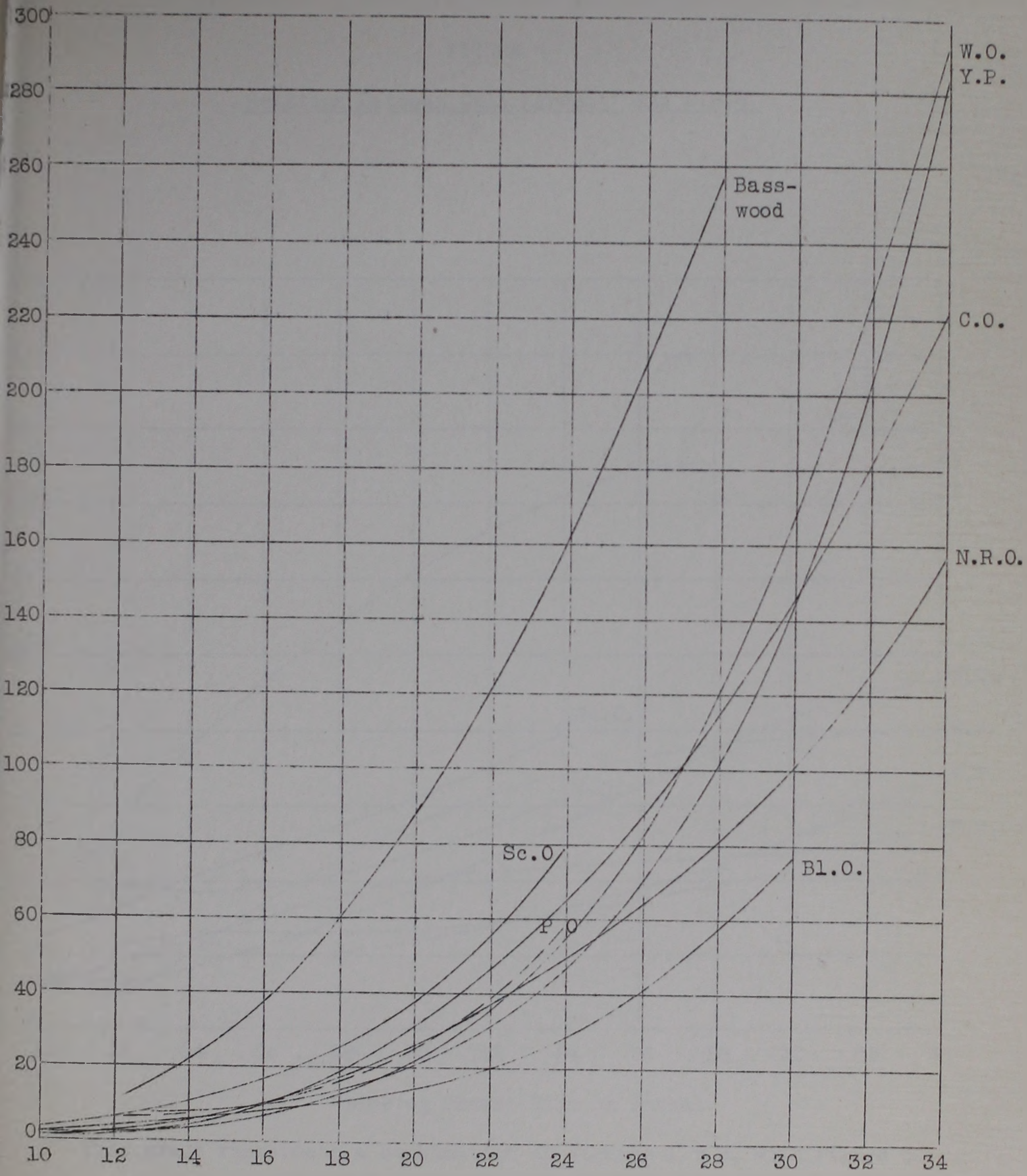


Diameter Breast High in Inches

*---Based on total volume from stump to top diameter to which operators cut.

FIGURE 3

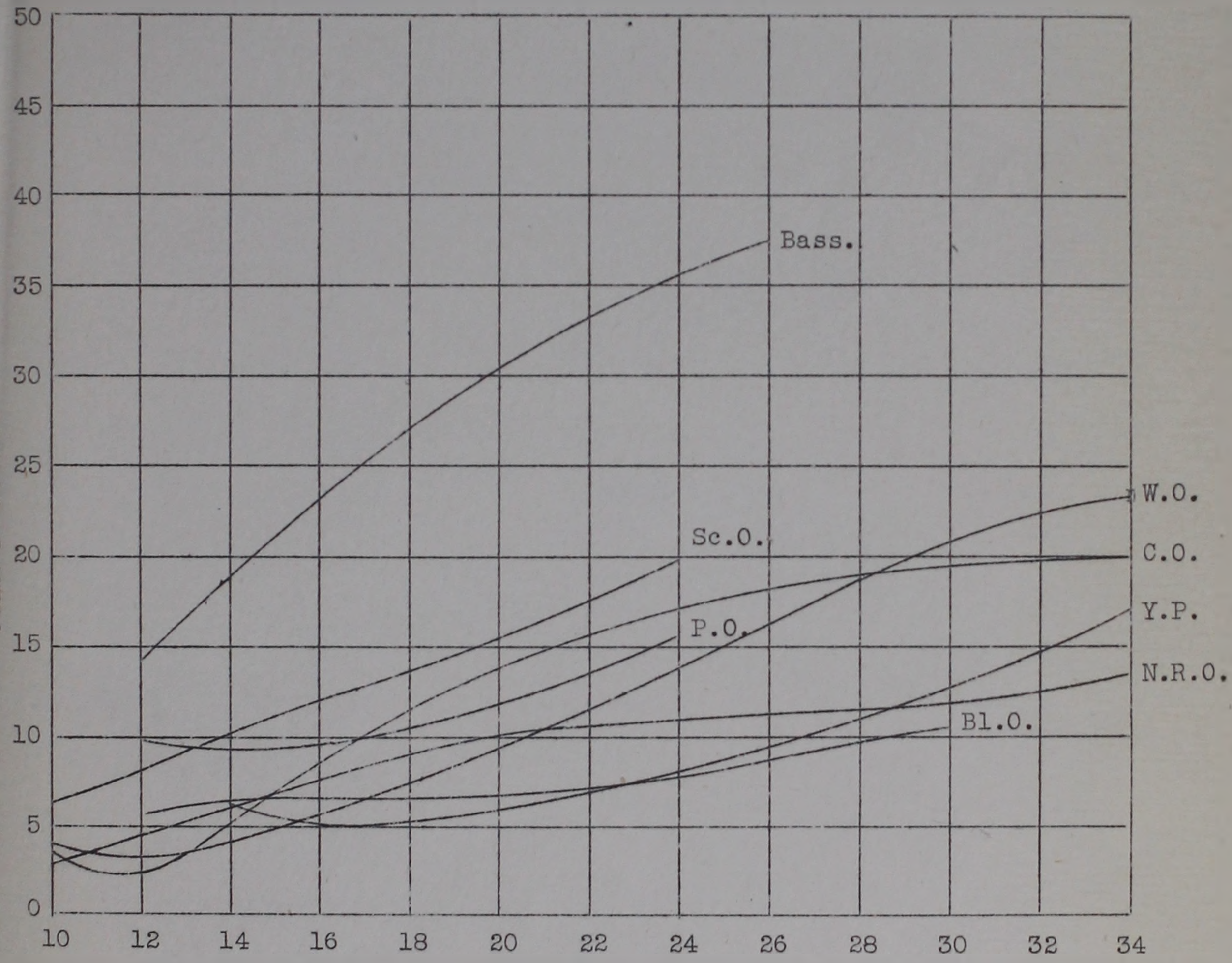
Relation Between Cull Volume and D.B.H.



Diameter Breast High in Inches

FIGURE 4

Relation Between Cull Percent* and D.B.H.



*--This graph represents a combination of Figures 1 + 2, with Figure 3.